1. Please read the abstract and table adapted from "Cumulative loads increase at the knee joint with slow-speed running compared to faster running: a biomechanical study" by Petersen J, Sørensen H, Nielsen RØ in J Orthop Sports Phys Ther. 2015 Apr;45(4):316-22 and answer the following questions 1-2 in Chinese.

STUDY DESIGN: Biomechanical cross-sectional study.

OBJECTIVE: To investigate the hypothesis that the cumulative load at the knee during running increases as running speed decreases.

BACKGROUND: The knee joint load per stride decreases as running speed decreases. However, by decreasing running speed, the number of strides per given distance is increased. Running a given distance at a slower speed may increase the cumulative load at the knee joint compared with running the same distance at a higher speed, hence increasing the risk of running-related injuries in the knee.

METHODS: Kinematic and ground reaction force data were collected from 16 recreational runners, during steady-state running with a rearfoot strike pattern at 3 different speeds (mean ± SD): 8.02 ± 0.17 km/h, 11.79 ± 0.21 km/h, and 15.78 ± 0.22 km/h. The cumulative load (cumulative impulse) over a 1000-m distance was calculated at the knee joint on the basis of a standard 3-D inverse-dynamics approach.

RESULTS: Based on a 1000-m running distance, the cumulative load at the knee was significantly higher at a slow running speed than at a high running speed (relative difference, 80%). The mean load per stride at the knee increased significantly across all biomechanical parameters, except impulse, following an increase in running speed.

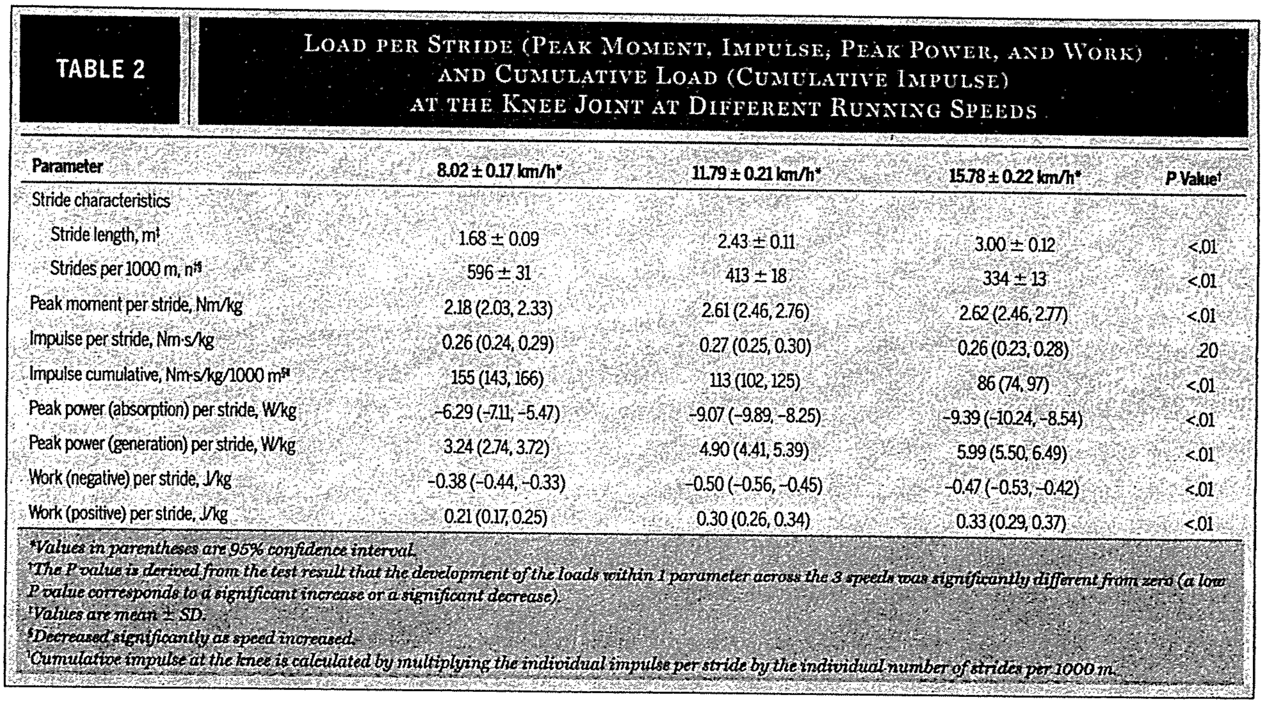

TABLE 2

LOAD PER STRIDE (PEAK MOMENT, IMPULSE, PEAK POWER, AND WORK) AND CUMULATIVE LOAD (CUMULATIVE IMPULSE) AT THE KNEE JOINT AT DIFFERENT RUNNING SPEEDS

Parameter	8.02 ± 0.17 km/h*	11.79 ± 0.21 km/h*	15.78 ± 0.22 km/h*	P Value†
Stride characteristics				
Stride length, m‡	1.68 ± 0.09	2.43 ± 0.11	3.00 ± 0.12	<.01
Strides per 1000 m, n‡§	596 ± 31	413 ± 18	334 ± 13	<.01
Peak moment per stride, Nm/kg	2.18 (2.03, 2.33)	2.61 (2.46, 2.76)	2.62 (2.46, 2.77)	<.01
Impulse per stride, Nm·s/kg	0.26 (0.24, 0.29)	0.27 (0.25, 0.30)	0.26 (0.23, 0.28)	.20
Impulse cumulative, Nm·s/kg/1000 m§‖	155 (143, 166)	113 (102, 125)	86 (74, 97)	<.01
Peak power (absorption) per stride, W/kg	−6.29 (−7.11, −5.47)	−9.07 (−9.89, −8.25)	−9.39 (−10.24, −8.54)	<.01
Peak power (generation) per stride, W/kg	3.24 (2.74, 3.72)	4.90 (4.41, 5.39)	5.99 (5.50, 6.49)	<.01
Work (negative) per stride, J/kg	−0.38 (−0.44, −0.33)	−0.50 (−0.56, −0.45)	−0.47 (−0.53, −0.42)	<.01
Work (positive) per stride, J/kg	0.21 (0.17, 0.25)	0.30 (0.26, 0.34)	0.33 (0.29, 0.37)	<.01

Values in parentheses are 95% confidence interval.
†*The P value is derived from the test result that the development of the loads within 1 parameter across the 3 speeds was significantly different from zero (a low P value corresponds to a significant increase or a significant decrease).*
‡*Values are mean ± SD.*
§*Decreased significantly as speed increased.*
‖*Cumulative impulse at the knee is calculated by multiplying the individual impulse per stride by the individual number of strides per 1000 m.*

Question 1. According to the results shown in table 2, please make a conclusion for this study. **(20%)**

Question 2. What are the implications of this study and how to apply the findings in your clinical practices? **(20%)**

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2. Please read the abstract adapted from "Addressing neuroplastic changes in distributed areas of the nervous system associated with chronic musculoskeletal disorders" by Pelletier R, Higgins J, Bourbonnais D in Phys Ther. 2015 Nov;95(11):1582-91 and answer the following questions 3-4 in Chinese.

Present interventions utilized in musculoskeletal rehabilitation are guided, in large part, by a biomedical model where peripheral structural injury is believed to be the sole driver of the disorder. There are, however, neurophysiological changes across different areas of the peripheral and central nervous systems, including peripheral receptors, dorsal horn of the spinal cord, brain stem, sensorimotor cortical areas, and the mesolimbic and prefrontal areas associated with chronic musculoskeletal disorders, including chronic low back pain, osteoarthritis, and tendon injuries. These neurophysiological changes appear not only to be a consequence of peripheral structural injury but also to play a part in the pathophysiology of chronic musculoskeletal disorders. Neurophysiological changes are consistent with a biopsychosocial formulation reflecting the underlying mechanisms associated with sensory and motor findings, psychological traits, and perceptual changes associated with chronic musculoskeletal conditions. These changes, therefore, have important implications in the clinical manifestation, pathophysiology, and treatment of chronic musculoskeletal disorders. Musculoskeletal rehabilitation professionals have at their disposal tools to address these neuroplastic changes, including top-down cognitive-based interventions (eg, education, cognitive-behavioral therapy, mindfulness meditation, motor imagery) and bottom-up physical interventions (eg, motor learning, peripheral sensory stimulation, manual therapy) that induce neuroplastic changes across distributed areas of the nervous system and affect outcomes in patients with chronic musculoskeletal disorders. Furthermore, novel approaches such as the use of transcranial direct current stimulation and repetitive transcranial magnetic stimulation may be utilized to help renormalize neurological function. Comprehensive treatment addressing peripheral structural injury as well as neurophysiological changes occurring across distributed areas of the nervous system may help to improve outcomes in patients with chronic musculoskeletal disorders.

Question 3. Please translate the abstract into Chinese. **(20%)**

Question 4. According to this article, please design your own interventions targeting chronic mechanical low back pain from top-down and bottom-up that help promote neuroplastic changes. **(20%)**

3. Please read the following paragraph adapted from "The Effects of Mirror Therapy in Stroke Patients with Complex Regional Pain Syndrome Type 1: A Randomized Controlled Study" by Vural SP, et al. in J Arch Phys Med Rehabil. 2015 Dec 23 and answer the following question 5 in Chinese.

Mirror therapy (MT) is a novel rehabilitation modality that was first introduced by Ramachandran and Rogers for phantom limb pain after arm amputation. In the concerned study, the reflection of the intact arm was used to simulate as the amputated limb was present. By this modality, pain relief and proper positioning were frequently observed. In the following years, the use of MT has been extended to hemiplegia rehabilitation, painful syndromes such as complex regional pain syndrome (CRPS), brachial plexus avulsion, peripheral nerve injury and post-surgical rehabilitation. In MT, the patient places the affected limb behind a mirror which is situated perpendicularly in the mid-sagittal plane. The patient perceives the visual image of the affected limb as normally functioning because of the superimposed unaffected side. MT's neurophysiological effect is on the neural network involved in motor image and motor execution overlap particularly in the premotor and parietal areas, basal ganglia and the cerebellum. It also provides plasticity of the neurons in the brain and has central effects on both the motor cortex and somatosensory cortex. In addition, MT is a simple, inexpensive and patient-based treatment. A systematic review comparing MT with other interventions in stroke rehabilitation revealed significant improvements in motor function and daily activities, but limited evidence for improving visuospatial neglect. A positive effect on pain was also demonstrated related to the fact that MT would be an effective intervention for both improving motor function and pain in CRPS type 1 (CRPSt1). However, the number of studies investigating the role of MT in hemiplegic patients with CRPSt1 is still limited. In this study, we hypothesized that combining MT with conventional stroke rehabilitation program would provide cortical reorganization and additional benefit on the improvement in motor recovery and symptoms related to CRPSt1. We designed this randomized controlled trial to evaluate the effects of MT on motor recovery, motor function, spasticity and pain intensity in the affected upper extremity.

Question 5. After reading the article, please summarize the research background and purpose. **(20%)**